THE BEAUFORT SEA IN A CANADIAN PERSPECTIVE

BY

A.E. PALLISTER

PALLISTER RESOURCE MANAGEMENT LTD.

CALGARY, ALBERTA

PRESENTATION TO

THE PETROLEUM SOCIETY OF

THE CANADIAN INSTITUTE OF MINING AND METALLURGY

FEBRUARY 25, 1976

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Mr. Chairman, Ladies and Gentlemen,

In early January I spoke to a meeting of many of the scientists responsible for the Beaufort Sea Project, a joint government/industry environmental investigation that is in the completion stages. This project was primarily directed to providing base-line data for use in determining the safeguards for offshore exploratory drilling for oil and gas in the Beaufort Sea. I chose to discuss this important area in a broader perspective.

That is, to speculate on the position that the Beaufort Sea might occupy in Canada's future - primarily in relationship to the development of new energy sources.

I am pleased to have the opportunity to review these thoughts with you in Ottawa, today.

In providing this perspective, I would like to comment in four subject areas:

1. The Canadian Energy Outlook

2. The Beaufort Sea within the Future Canadian Energy Scene

3. Government, Industry and the Public - Sharers of Risks and Benefits

4. Providing for the Interests of the "Risk-Takers"

THE CANADIAN ENERGY OUTLOOK

Much has been written, much has been said, about Canada's Energy Future. The only thing that one can say with absolute certainty is that there exists a great deal of uncertainty!

Actually, I think the outlook is reasonably clear. The demand requirements are rather certain, and the supply possibilities are becoming more well defined. The options we have available to us to minimize adverse economic and social impact are becoming increasingly limited.

It is indeed unfortunate that various information sources at various times have provided, and continue to provide, the already confused observer with wide ranging "statistics" about energy "reserves". As a result, the credibility of spokesmen has been strained beyond its elasticity and scepticism is rampant. The cacophony reaching the public results largely from two factors. First, is the co-mingling of known quantities with potential estimates - with inadequate qualification as to the degree of guesswork that is involved. Second, is the mind-boggling use of millions, billions and trillions even quadrillions of barrels, cubic feet, b.o.e.'s, b.t.u.'s in a mixture of per hour, per day, per year and total volume. If this doesn't sufficiently confuse, the fine points of terminology of ultimate, in-place, recoverable, possible, probable, proved, remaining, economic, marketable, established, primary/secondary, producibility/production, consumption/demand provide the final exasperation. And that's only for oil and gas. A comparable but different shopping list of quantities and terms apply to each of the nuclear, coal and hydro sources of energy.

Today, in describing Canada's energy outlook and the Beaufort Sea's relationship to it, I do not intend to struggle with such complexity. Rather, in the hope of providing simplicity, I will introduce yet another term. The "C". It is more of a convenient yardstick (or should I say metre stick) for after-dinner speakers than a scientific quantity.

The unit C is the combined Canadian consumption of oil and gas in 1975.

Let me attempt to relate some known past and present information and postulated future numbers in units of C.

1. SUPPLY

Prior to 1975 - Reserves

The following are "known" (that is, there is a high degree of accuracy).

We had discovered	35 C
of which we had developed	32 C
of which we had produced (used and exported)	12 C
leaving developed supplies remaining of	20 C
plus discovered but yet to be developed	3 C

After 1975 - Potential

The following are postulated (that is, there is a low degree of accuracy).

Undiscovered potential (conventional oil)	160 C
Undeveloped potential (oil sands - mining)	28 C
Undeveloped potential (oil sands - insitu)	265 C

These very large potential figures which add up to over 450 C provide what would appear to be a very comfortable base for future supplies. When, however, the ingredients of capital and technology necessary to transfer a portion of these potentials to freely available supplies are introduced, we find that the figures must be very severely discounted.

2. DEMAND

Prior to 1975 (Known)		
We had produced (used and exported)	12 C	
After 1975 to 1995 (Forecast)		
We will require in Canada from Canadian and foreign sources (assuming conservation)		27 C
Present reserves can supply (to 1995)	13 C	
New discoveries in established areas might supply	4 C	
Oil sands might supply	3 C	
		20 C
The remainder which must come from Canadian frontiers or foreign sources (cost estimate $75 billion)		7 C

Thus, of the tens or even hundreds of C of potential oil and gas resources, if we can have a new 7 C within grasp during the next twenty years we could provide for our needs entirely from domestic sources. If this is done, the adverse economic and social impacts of costs of importation, imbalance of trade, and insecurity of supply could be avoided. And in doing so, we can provide jobs for citizens; an energy cornerstone for our industries and consumers and royalty income to governments.

By comparison to other numbers I have given, 7 C sounds quite modest and appears readily attainable.

Yet, I doubt that the new 7 C will be available when we need it. I say this for the following reasons:

1. To have 7 C delivered during the next 20 years, there needs to be discovered and developed sufficient (about 3 times) reserves to provide the thresholds to justify delivery systems from the frontiers and they must be in place. We are likely already past the point of lead time date necessary to see the establishment of frontier threshold volumes and delivery systems.

2. The cost of new oil and gas will be very high. Using an approach of adapting differing geology and differing exploration and development costs of various frontier areas to known results in western Canada, I recently calculated the average developed field cost of frontier oil as $11.00/barrel. (1974 dollars).

This cost estimated is comprised of:

Exploration	$ 1.62	
Development	1.06	
Capital Employment	8.32	(after-tax 10% return on (new) investment)
	$11.00	

You will note that the largest component of cost of frontier oil is the cost of employment of capital during the 2 decades preceding market delivery which then provides the return of investment over a further 2 decades or more during delivery.

This $11.00 figure is not inclusive of operating or transportation costs which can add another $3.00 or more. Having already exceeded current international price in these calculations, I hesitate to speculate the full cost with the addition of government assessments in the form of royalties or profit sharing (on the isolated profitable ventures).

If these estimates turn out to be actual, as consumers we may conclude that indigenous supplies are too costly and either as a matter of government policy, or as the result of the direct economic impediment we will not see the necessary front-end investments forthcoming from industry, or government for that matter.

3. The pace of investment and subsequent development will be determined to a large degree by non-economic, not technological, external considerations. Here, I refer to the incorporation of the social, cultural, environmental, political and public processes in policy development and decision making.

In a nutshell, it seems clear to me that the 20 year Canadian energy outlook can be described as follows - and not much can be done to change it.

OIL

- We will continue to rely on oil and gas for more than half of our energy (now 63%).
- As our production of oil from established areas (notwithstanding oil sands production increases) declines to two-third's of todays level during the next ten years, our consumption will increase by a third. In 1975 we were capable of producing slightly more than we consumed. By 1985 we will produce from established areas only 50% as much as we consume. In the absence of frontier sources, we will be dependent on annual imports to supply 1/2 C in 1985 and 3/4 C in 1995 by which time imports will comprise 2/3 of our supplies. Supplies from frontiers could reduce imports to 4/10 C or 33% of our consumption by 1995.

GAS

- Production of natural gas will continue to exceed our consumption until 1985. By 1995 production from established areas will have decreased to 50% of consumption. If new finds from frontiers are available, supplies as much as 30% in excess of consumption could be maintained continuously through 1995.

TOTAL OIL PLUS GAS

- Producibility will exceed consumption for another five years to 1980. After 1980, the following five years will see a net deficit about equivalent to the preceeding 5 year surplus. After 1985 the degree of self-sufficiency will decline from 70% to as low as 40%. The introduction of oil and gas supplies from frontiers could gradually increase the percentage of self-sufficiency from 70% to about 90%. To effect this higher percentage of self-sufficiency would see a full C being produced annually from new frontier sources by 1995.

It is very important to look at oil and gas in combination. They are searched for together, financed together and often interdependent in production. When we do this and relate domestic producibility to domestic consumption, the future energy scene can be simplified into two distinct decades. 1976-1985 and 1986-1995.

To 1985, in total oil plus gas energy we face no serious production versus consumption or payment imbalances providing gas and oil surpluses are exported to pay for oil imports.

By 1985, the deficit gap will begin to have reached 30% of consumption. After 1985, percentage net self-sufficiency will fall from this 70% level to under 50% within a few years. Or it could be maintained at 70% to 90% (or even over 100% could be regained) dependent upon the rate and volume at which frontier supplies can then come onstream. Unfortunately, the decision of where we want to be in the second decade cannot be made then. It must be made now. If our choice is for a high level percentage of self-sufficiency beyond 1985, the investments must be made at once and continually grow through the first decade to 1985. If we consider it important to maintain a continuous high degree of oil and gas energy self-sufficiency; annual exploration and development expenditures and activity

levels will need to be increased four-fold during the next few years.

The decision of what percentage of net self-sufficiency constitutes an acceptable level of self-reliance will be determined by balancing the impacts of high product costs and potential adverse social costs on the one hand versus energy insecurity, international payment deficits and under-employment of people, on the other hand.

THE BEAUFORT SEA WITHIN THE FUTURE CANADIAN ENERGY SCENE

The continental shelf of the Beaufort Sea together with the Arctic coastal plain and the Mackenzie delta under which potential oil and gas reservoirs lie is about 60% of the size of the Province of Alberta. To date over 100 wells have been drilled north of latitude 68^{o} in the western Canadian Arctic onland and from near shore man-made islands. Twenty-five of these have encountered some oil or gas. Oil has been found at six locations but offset drilling has shown the reservoirs to be of limited size; thus no significant oil reserves can be considered as having yet been established. Gas has been discovered in seven areas. Reserves of 1/2 C have been discovered. Extensions to these fields could double this figure. (A gas pipeline requires a threshold of 2 C; an oil pipeline requires a threshold of 3 C.)

Offshore, marine seismic surveys have shown the existence of numerous and large sub-surface structures of the type conducive to oil entrapment.

Of the 160 C of undiscovered potential (conventional) oil and gas mentioned earlier; an amount of 24 C has been attributed to the Mackenzie delta/Beaufort Sea area. This estimate has been derived from published work of the Canadian Society of Petroleum Geologists. This is equivalent to:

- 85% of the oil and gas discovered to date in the four western provinces;
- 1-1/2 times the oil and gas likely left to be found in the established areas.
- Other estimates vary from less than 20 C to as much as 80 C.

Before accepting any of these estimates of the oil and gas potential of the Beaufort Sea, it is necessary to make two important qualifications. Firstly, the estimates are based on a geological interpretation of indirect geophysical evidence and the extrapolation of onshore and near shore geology; and secondly, these potentials must be discounted to recognize that only if oil and gas is found in thick, vertical pay zones will offshore production be commercially economic.

Determination of the actual occurence and quantity of oil and gas under the Beaufort Sea awaits several years of exploration drilling. In plain language, like other frontier areas we do not know what our resource base is. Until wells are drilled we will continue to not know. Assuming its presence, the maximum amount of oil and gas that might be delivered during the next forty years can be estimated since it is dependent upon the exploration and development pace which in turn, is subject to certain limitations of capital, technology, logistics, policy and above all, time.

One could reason that during the next 10 years, say 30% of the estimated 24 C potential is discovered in the confined configuration capable of high productivity to make it economically produceable, and is developed. (This is the historical percentage of large fields in southern Canada). This would indicate an availability of 7 C being produced after 1985 over the then following thirty year period during which Canadian consumption would total some 60 C. In very general terms then, this geological province might provide 10% to 15% of Canada's oil and gas requirements during 1985-2015.

Why 1985? Like other frontier areas, the elapsed times leading to Beaufort Sea offshore oil and gas production are extensive.

- Geophysical work was first performed in coastal waters in 1960.
- Offshore permits were first issued in 1963.
- Application for drilling from a floating system were submitted in 1972.
- Drilling Approvals in Principle were granted in 1973, 1974.
- The Beaufort Sea Environmental Project was conducted in 1974-75.
- First exploratory drilling is planned for 1976.
- Significant quantities of oil and gas could be discovered by 1980, by which time some 25 wells may have been drilled, (by 1974, after 10 years over 100 wells were drilled on Canada's Atlantic continental shelf without commercial discovery).
- Providing that commercial discoveries are made, field delineation and installation of year-round field production and field to shore delivery facilities and southern pipelines could take until 1985.

In all, 25 years from concept to produceability.

Assuming threshold levels of discoveries are made during the next five years, production of oil and gas from beneath the Beaufort Sea requires several technology advancements to establish permanent production methods and delivery means compatible with 9 month ice presence, seabottom ice scour and subsea permafrost. This would place 1985 as the earliest date of arrival of Beaufort Sea oil or gas in southern Canada.

All forecasts of future supply and demand for oil and gas in Canada predict a widening gap between a decreasing domestic producibility and an increasing domestic consumption. Canada can accommodate the resulting oil and gas deficit in a number of ways.

- Oil can be imported and international petroleum trade deficits balanced through exports of other commodities, such as manufactured goods, other minerals and agricultural products.
- Oil and gas consumption can be reduced through conservation, primarily through the elimination of waste and more efficient energy utilization. (The consumption forecasts referred to earlier have assumed a lower rate of consumption growth than in the past).
- Moves can be made toward less dependency on oil and gas for energy by developing other energy sources, particularly renewable (and virtually inexhaustible nuclear ones).
- New oil and gas sources can be explored for and developed in frontier areas and from oil sands and coal gasification.

In order to maintain a secure energy base in future years, Canada will probably want to do all these: import, conserve, substitute and develop new sources of oil and gas. These new oil and gas sources lie predominantly in petroleum frontiers such as the Beaufort Sea.

GOVERNMENT, INDUSTRY AND THE PUBLIC - SHARERS OF RISKS AND BENEFITS

Up to this point I have talked about physical and economic aspects of the Beaufort Sea in the context of the future Canadian energy picture. The socio-cultural aspects are vitally important, and much more than a side issue. They will have a significant influence on the pace of investment and can determine the rate of return of investment. External factors thus will have a marked impact on the economic viability of the development of potential resources.

During the past several years the "Public Interest" has emerged as a distinct interest seen to be beyond that which is encompassed within governments mandates. For this reason I have isolated the public as a "sector", notwithstanding the knowledge that governments are constitutionally the custodians of the public or national interest.

I view the three sectors - government, industry and the public (particularly northern residents) - as being obliged to take certain risks in the expectation of gaining less-certain rewards. In each case it is much more easy to define the risks than the rewards.

The reasonableness of the relative sharing of risks and benefits is a complex issue that can't be resolved in any short time frame. It's a matter that will need continuous definition and monitoring.

To mention only a few of the more obvious risks and benefits related to offshore drilling in the Beaufort Sea:

PUBLIC

Risks to the northern public are centered around the environmental damage which could result from an oil spill from an accidental blow-out during drilling operations in the short term, and the more subtle but probably greater cumulative environmental impact from production and transportation activities in the long term. Risks of undesireable social impacts related to the introduction of industrial activity are more difficult to quantify but are equally real.

Countering benefits lie in meaningful employment backed up by education and training programs and the gaining of the desireable aspects which accompany growth. Indirect financial benefit could flow from production royalties which could provide financial independence and increased jurisdictional autonomy to northerners.

INDUSTRY

Risks to industry are largely financial. The initial exploratory wells will be the most expensive ever drilled. At a cost of $35 million each, they are more than 7 times the cost of comparable wells on the Atlantic continental shelf. The final cost of the oil and gas, including production and transportation facilities is an unknown.

Benefits of course lay in the confidence that these costs will be less than the revenue and the oil and gas production will result in a profit commensurate with the risk.

GOVERNMENT

Risks to government are wide ranging. As custodians of the interests of all Canadians, governments fall when they fail to meet national economic aspirations. The failure to provide secure domestic sources of energy can cause multifold negative economic impacts on consumers, manufacturers, balance of payments and employment.

Direct benefits can accrue from royalty income and taxation to finance national programs and can provide opportunities for greater viability in Territorial governments' financial independence. The 1976 drilling of the first exploratory wells in the Beaufort Sea will provide vitally needed information on Canada's resource base. Activities of the nature of offshore drilling in ice infested waters provide opportunities to fulfill national policies such as Canada's Ocean Policy. Oil and gas operations provide the most immediate and direct means of forwarding Canadian oceanographic expertise. This activity can serve as the beginning stages of providing a Canadian operational presence and experience to assure the understanding, protection, management and control of undersea territory within Canada's jurisdiction.

Beyond adding materially to the effective development of new technology and technical expertise within a growing Canadian oceans industry, it will display to other marine nations the international ocean research and development responsibilities being accepted by Canada. The future "spin-off" flowing from the offshore drilling can be significant to the development and operation of other Canadian ocean industries including transportation and the management of other minerals and of living resources in ice covered waters. This applied research spans the fields of instrumentation, marine geology and geophysics, marine biology, physical and chemical oceanography, all of which will be applicable to other Canadian continental shelves and will strengthen Canada's ability to fulfill international bilateral cooperation and to export marine products, and services.

PROVIDING FOR THE INTERESTS OF THE "RISK-TAKERS" - THROUGH COMMUNICATION, CONSULTATION AND COOPERATION

For five years the manner in which exploratory drilling would take place has been the subject of discussion and concern by members of government, industry and the public. The issues have been essentially a measuring of the risks and benefits with the goals and apprehensions of the three sectors. The risks and benefits are seen quite differently by the three sectors.

Fortunately, during the past two years the acknowledgement of each other's risks has advanced. This increased mutual understanding has been greatly advanced by the Beaufort Sea Environmental Project in which 200 environmental scientists and engineers in government and industry have worked together and exchanged knowledge in pursuit of gradually more common concern.

As well, from this project has come a dialogue between the industry sponsors of the Beaufort Sea Environmental Project, and hundreds of citizens. A public information program at the industry/public interface is being conducted by Mary Collins Consultants Limited and Pallister Resource Management Ltd. Information is not only provided to the public, but public attitudes are learned. In the communities bounding the Beaufort Sea, for example, discussions of the environmental project with the residents is giving oil companies a clearer insight into the concerns of those whose predecessors inhabited these lands for thousands of years and who are now being expected to accept very rapid change.

The tough job of rationalizing the potential impact of development on the Arctic physical and human environments with the needs of the Canadian economy and other Canadian citizens rests with the Federal Government. Prior to the issuance of drilling authorities the government's interdepartmental Arctic Waters Oil & Gas Advisory Committee has visited Arctic communities to discuss the Department of Environment's Environmental Assessment Report which summarizes the results from the Beaufort Sea environmental studies.

The environmental studies are being related by the Department of Indian and Northern Affairs to the subjects of drilling technology, blowout occurences and prevention, oil spill counter measures, Canadian energy alternatives and socio-economic impacts; which are not assessed in detail in the environment studies.

While it is highly unlikely that concensus will be reached or maintained between government and industry, between government and the public or between the public and industry, it is meaningful that during the past two years all significant information on the Beaufort Sea Environmental Project

has been widely disseminated and that an opportunity has been provided for the potential risk-takers/beneficiaries to air their views. It will be important that this environmental knowledge continues to be advanced and that the communication process continue.

Although it is theoretically desirable to have all planning and research in hand before proceeding with development, the experience of "doing" often results in the most meaningful research results. At the 1972 Mont Gabriel Seminar on Guidelines for Scientific Activities in Northern Canada, I commented on the subject of "Research in Progress":

> "Research, as an exploration of the unknown, cannot be entirely planned in advance; the needs for further work emerge as interim results are obtained from research that is on-going. This feed-back feature should encourage us to monitor research that is on-going with a view to adjusting its orientation as our understanding grows."

I believe that the question is not - when does research stop? but, when does development progress? The answer lies in the assessment, approval and regulatory processes, which in the case of Beaufort Sea drilling are being undertaken by the Federal Departments of Environment and Indian and Northern Affairs.

There will be greatly expanded needs for environmental and industrial research during the next decade as the unknowns in and beneath the Beaufort Sea gradually unfold.

In the Beaufort Sea example, much has been learned from the environmental studies and much research has gone into the design of ships, support vessels, ice-related operational procedures and oil spill contingency planning. Yet some potential problems are today without exact solutions. The environmental protection requirements included in the drilling authorities can be expected to assure that risks of harmful environmental impact related to these potential problems are within tolerable limits.

The first year's drilling activity in the Beaufort Sea will undoubtedly provide additional new information and experience from which industry, government and the public can expand their ability to orient future exploration and development drilling.

In the longer range, if exploratory results do show the presence of oil and gas in large volumes, a quantum increase in both environmental and industrial research will be necessary to lead to the operation of year-round drilling and production systems. This research will be directed toward new methods of working on or beneath the sea floor and of establishment of permanent in-ice offshore structures. Similarly, research will be necessary to establish methods of installing sub-bottom pipelines able to accommodate localized presence of ice scour and sub-sea permafrost.

Without underestimating the technological, economic and natural environment requirements of future oil and gas development in the Beaufort Sea, perhaps the most significant determinant of the pace of activities will be the rate of evolution of a "cohabitation" formula - a means by which a satisfactory balance of interests of development, environment and people is insured.

By cohabitation I mean a combination of communication, consultation and cooperation.

It strikes me as incredibly unproductive that we in Canada should find ourselves resorting to internal confrontation and conflict when we have so many challenges and opportunities to work together positively, in the attainment of national prosperity, identity and unity.

Certainly there are adverse viewpoints between the three risk-takers and within these sectors themselves. But does this mean we must resort to a counter productive adversary system to settle differences? Does there have to be winners and losers?

I firmly believe that the public interests, the industry interests and the government interests will all be maximized, and thus the national interest will be fulfilled when each of the three advance from being uninformed adversaries to become enlightened cohabitants in search of common beneficial interests.

It's an open and closed case. Closure will lead to opposition and confusion. Openess will lead to candor and opportunity.

The Beaufort Sea environmental project has made many strides in accomplishing mutual understanding of the environmental and human resources at stake. Let us hope it is a chapter of a continuing process, just as the initial offshore drilling is but a link in a decades long chain of learning our resource base, and how to develop it responsibly.

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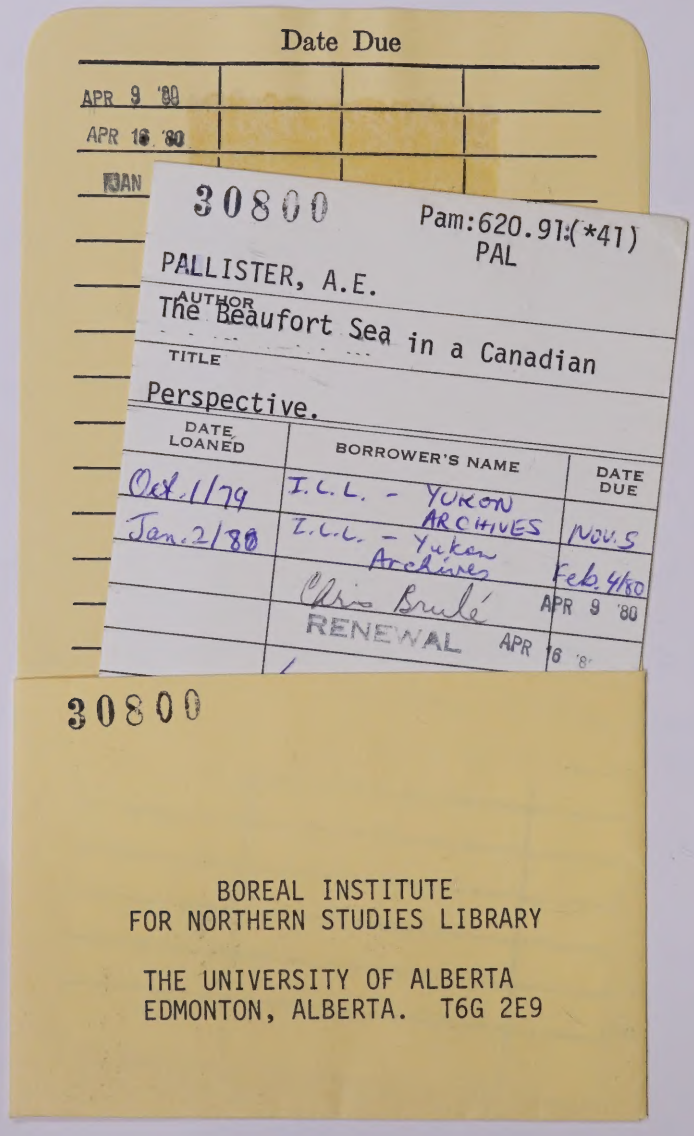

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